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EXAMINER

VARTANIAN, HARRY

ART UNIT

PAPER NUMBER

2634

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8

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/737,093

Applicant(s)

PUKKILA ET AL.

Examiner

Harry Vartanian

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 07 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 December 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- ☒ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

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**Detailed Action**

***Response to Arguments***

1. Applicant's arguments filed 6/7/2004 have been fully considered but they are not persuasive. Bar-David specifically mentions that not only is the channel iteratively estimated but the received signal is also iteratively equalized. Bar-David recites:

"In a receiver implementing **an iterative equalization** and **decoding scheme**, the symbol decisions can be obtained from the A Posteriori values for the coded bits provided by a soft-in/soft-out channel decoder...**receives the input signal** 6, which represents a) the re-encoded (and re-interleaved) version of the channel decoder hard-output, or b) the (re-interleaved) most significant bit of the log-likelihood ratios (or L-values) for the coded bits provided by a soft-in/soft-out decoder, typically employed in an **iterative equalization** and decoding scheme ...Apart from this difference, the channel estimator functions according to the same strategy described for steps (1) and (2) above." (Column 4, Line 56 to Column 5, Line 12)

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

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1. Claims 1-3, 14, 20 and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Bar-David et al (US Patent# 6459728). Regarding Claim 1, Bar-David et al meets the following limitations:

- generating an initial estimate of the impulse response of a radio channel, **(Column 4, Lines 25-55)**
- equalizing a signal by using the initial estimate, **(Column 4, Line 56 to Column 5, Line 12)**
- obtaining feedback information from the signal after equalization, **(Column 4, Lines 35-40)**
- generating an updated estimate of the impulse response of the radio channel by using said feedback information, **(Column 4, Lines 35-55 ); Abstract**
- equalizing the signal by using said updated estimate and said feedback information and decoding the equalized signal. **Fig 4; (Column 4, line 10 to Column 5, line 27)**

Regarding Claim 2, Bar-David et al meets the following limitations:

wherein the step of obtaining feedback information from the signal after equalization is performed after the step of decoding the equalized signal, so that said feedback information concerns the equalized and decoded signal. **(Column 4, Lines 35-55); Fig 4**

Regarding Claim 3, Bar-David et al meets the following limitations:

wherein the step of obtaining feedback information from the signal after equalization is performed at least partly before the step of decoding the equalized signal, so that said feedback information concerns at least partly the equalized but not decoded signal. **(Column 4, Lines 35-55); Fig 4**

Regarding Claim 14, Bar-David et al meets the following limitations:

- between the steps of equalizing a signal and decoding the equalized signal, processing the signal and **(Column 4, Lines 65 to Column 5, Line 12)**
- between the steps of obtaining feedback information from the signal after equalization and generating an updated estimate, inversely processing the feedback information to cancel from the feedback information certain effects caused by said step of processing the signal. **See Fig 4 items 12, 15**

Regarding Claim 20, Bar-David et al meets the following limitations:

- a channel estimator for generating an initial estimate of the impulse response of a radio channel, **(Column 4, Lines 65 to Column 5, Line 12)**
- a signal equalizer for equalizing a signal, the signal equalizer being coupled to the channel estimator so as to receive the estimate generated by the channel estimator, **(Column 4, Lines 65 to Column 5, Line 12); Fig 4**
- a decoding unit coupled to the signal equalizer for decoding the equalized signal, and **(Column 4, Lines 65 to Column 5, Line 12); Fig 4**
- means for coupling feedback information from a point located after the signal equalizer into the channel estimator and the signal equalizer; wherein **(Column 4, Lines 65 to Column 5, Line 12)**

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- the channel estimator is arranged to generate an updated estimate of the impulse response of the radio channel by using said feedback information and **(Column 4, Lines 65 to Column 5, Line 12)**
- the signal equalizer is arranged to re-equalize the signal by using said feedback information. **(Column 4, Lines 65 to Column 5, Line 12)**

Regarding Claim 26, Bar-David et al meets the following limitations

comprising a first signal processing block coupled between the signal equalizer and the decoding unit, and a second signal processing block coupled between the decoding unit and the channel estimator, so that said second signal processing block is arranged to implement the inverse of the signal processing operations implemented by said first signal processing block. **See Fig 4 items 12, 15**

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claim 4-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bar-David et al(US Patent# 6459728) in view of applicant's admitted prior art. Bar-David et al meets the following limitations of Claim 4:

- a) receiving a transmission sequence containing, modulated onto a carrier, a certain known symbol sequence and certain unknown symbols, **(Column 1, Line 55 to Column 2, Lines 34; Focus on Column 2, Lines 26-34 for known vs. unknown symbols)**
- b) converting the received transmission sequence into a sample sequence so that a certain first group of samples within said sample sequence represents said known symbol sequence and a certain second group of samples within said sample sequence represents said unknown symbols, **(Column 3, Line 53 to Column 4, Line 19); (Column 4, line 56-64)**

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c) using said first group of samples to generate an estimate of the impulse response of the radio channel over which the transmission sequence was received, **(Column 1, Line 55 to Column 2, Lines 34); (Column 4, Lines 25-33)**

e) making a number of decoding decisions by using said first piece of hard decision output and first piece of soft decision output. **(Column 4, Lines 65 to Column 5, Line 12)**

Bar-David et al briefly discusses the use of hard and soft decision outputs in Column 4, Lines 65 to Column 5, Line 12. However he fails to specifically state that the equalizer produces the hard and soft decision outputs(see Column 4, Lines 65 to Column 5, Line 12).

Therefor the following limitations are not met:

d) equalizing said sample sequence by using the estimate generated at step, thus generating

- a first piece of hard decision output that maps a number of equalized samples from said second group of samples into information symbol values and

- a first piece of soft decision output that describes the estimated reliability of said hard decision output,

However, the applicant admits to the outputting of a hard and soft decision part as admitted prior art in fig 1 and page 1 lines 23-38. Therefor it would have been prima facie obvious at the time the invention was made that Bar-David's equalizer output and feedback both soft and hard decision information. A motivation to combine is that both the soft and hard decision outputs can be useful information in the decoder for error checking and decoding.

Regarding Claims 5-8, the rejection above also applies. The Claims further limit Claim 4 by disclosing that the hard and soft decision data are feedback to generate "an updated estimate of the impulse response". Bar-David et al in combination with applicants admitted prior art meet these limitations.

Regarding Claim 9, Bar-David et al meets the following limitations:

comprising repeated iterations through steps c), d) and e) so that at the second and each subsequent time of executing step c) both said first group of samples and said feedback information are used to generate an estimate of the impulse response of the radio channel over which the transmission sequence was received. **(Column 4, line 10 to Column 5, line 27)**

Regarding Claim 10, Bar-David et al meets the following limitations:

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wherein at the second and each subsequent time of executing step d) there is used the most recently generated updated estimate of the impulse response of the radio channel to equalize said sample sequence. **(Column 4, line 10 to Column 5, line 27)**

Regarding Claim 11, Bar-David et al meets the following limitations:

- feeding back said decoding decisions to the step of equalizing said sample sequence, **fig 4**
- repeatedly iterating through steps d) and e) and **Abstract; (Column 4, Line 10 to Column 5, line 27)**
- at the second and each subsequent time of executing step d) using both said sample sequence and feedback information from said decoding decisions to equalize said sample sequence. **(Column 2, Lines 26-47); (Column 4, Lines 35-55) fig 4**

Regarding Claim 12, Bar-David et al meets the following limitations:

- repeatedly iterating a first number of times through steps c), d) and e) so that at the second and each subsequent time of executing step c) both said first group of samples and said feedback information are used to generate an estimate of the impulse response of the radio channel over which the transmission sequence was received and **(Column 2, Lines 26-47); (Column 4, Lines 35-55); (Column 4, Lines 65 to Column 5, Line 12 )**
- repeatedly iterating a second number of times through steps d) and e) so that at the second and each subsequent time of executing step d) both said sample sequence and feedback information from said decoding decisions are used to equalize said sample sequence. **(Column 2, Lines 26-47); (Column 4, Lines 35-55); (Column 4, Lines 65 to Column 5, Line 12)**

Regarding Claim 13, Bar-David et al meets the following limitations:

- step a) comprises the step of receiving simultaneously at least certain first and second transmission sequences where within said first transmission sequence the first group of samples represents a certain first known symbol sequence and within said second transmission sequence the first group of samples represents a certain second known symbol sequence which is different than said first known symbol sequence and **(Column 1, Line 55 to Column 2, Lines 34; Focus on Column 2, Lines 26-34 for known vs. unknown symbols;)** **(Column 4, Lines 35 to Column 5, Line 12)**
- steps b) to e) are performed separately to both said first transmission sequence and said second transmission sequence. **(Column 2, Lines 26-47) (Column 4, Lines 35 to Column 5, Line 12 )**

3. Claim 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bar-David et al(US Patent# 6,459,728) in view of Desperben et al (US Patent# 5,331,662).

Regarding Claim 15, Bar-David et al meets the following limitations:

- determining the value of a quantity that describes the estimated quality of a received signal, **(Column 4, Lines 25 to Column 5, Line 12); Abstract**
- generating an initial estimate of the impulse response of a radio channel, **(Column 4, Lines 65 to Column 5, Line 12); Abstract**
- equalizing the received signal by using the initial estimate, **(Column 4, Lines 65 to Column 5, Line 12); Abstract**
- generating an updated estimate of the impulse response of the radio channel by using said feedback information and **(Column 4, Lines 65 to Column 5, Line 12)**

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-equalizing the signal by using said updated estimate; and decoding the equalized signal. **(Column 4, Lines 65 to Column 5, Line 12); Fig 4**

Bar-David et al fails to teach the use of a threshold metric to measure the quality of the estimation system against some threshold.

However, Desperben et al meets the following limitations:

- comparing the determined value of the quantity that describes the estimated quality of the received signal against a certain first threshold, **Abstract**

- if said comparison shows the estimated quality of the received signal to be better than indicated by said first threshold, obtaining feedback information from the signal after equalization, **Abstract**

Therefor it would have been prima facie obvious at the time the invention was made that Desperben et al's to use a threshold to measure the quality of equalization with Bar-David's equalization system. The motivation to combine is that a metric is needed in order to determine the number of iterations needed until the equalizer falls upon a good estimate of the channel. If the equalizer runs continuously, precise computing resources can be wasted(Please read Background and Summary of the Invention of Desperben for further motivations).

Regarding Claim 16, Bar-David et al meets the following limitations:

wherein said step of equalizing the signal comprises the step of equalizing the signal by using said updated estimate and said feedback information. **(Column 4, Lines 65 to Column 5, Line 12)**

Regarding Claims 17-19, the rejection for Claim 15 also applies here. Desperben discloses the final limitation of Claim 17 regarding the iterations in the abstract. Claim 18 and 19 are specifically disclosed in Claim 1 where the full operation of the iteration is discussed.

4. Claim 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bar-David et al(US Patent# 6,459,728) in view of Smith et al (US Patent #6,304,995). Bar-David et al meets all the limitations of Claim 21(see above paragraphs) except for disclosing that his decoder contains two decoders in series.



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However, Smith et al meets the following limitations:

wherein the decoding unit comprises a series coupling of a first decoder and a second decoder, and the coupling for providing feedback information is made after said first decoder but before said second decoder. **Fig 2**

Therefor it would have been prima facie obvious at the time the invention was made that Bar-David et al's decoder be composed of two decoders in series. The motivation to combine is that it is well-known in the art that two SISO decoders are used in turbo decoders. This is confirmed by Smith et al in Column 5, Lines 23-27 where he states that the turbo decoder in fig 2 is basic.

Regarding Claim 22, Smith et al meets the following limitations:

wherein the decoding unit comprises a series coupling of a first decoder and a second decoder, and the coupling for providing feedback information is made after said second decoder. **Fig 2**

Regarding Claim 23, Bar-David et al meets the following limitations:

wherein the coupling for providing feedback information to the channel estimator is made after the the signal equalizer but before the decoding unit. **Fig 3**

5. Claim 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bar-David et al(US Patent# 6,459,728) in view of Desperben et al (US Patent# 5,331,662) further in view of Brink (US Patent #6,304,995). Regarding Claim 24-25, Bar-David et al and Desperben et al meet the limitation of the Claims regarding the use of a quality threshold to determine the number of iterations needed(please see the above paragraphs). What they fail to teach is the use of a controller.

However, Brink discloses:

"A signal to noise ratio estimator 18 estimates the signal to noise ration in the channel signal. A controller 20 determines, amongst other things, how many iterations can be used for the channel. The number of iterations could change for a number of reasons, e.g. in order to reduce power consumption, the receiver could reduce the number of iterations, or in a multi-user receiver computing resources available for iterative decoding may be shifted from one user to another higher priority user." (**Column 8, Lines 5-13**)

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Brink also shows in fig 4 that the controller is coupled to the receiver's decoders. Therefore it would have been prima facie obvious at the time the invention was made to use a controller in Bar-David et al's iterative equalizer. The motivation to combine is that it is well-known in the art that a controller is a common component in a receiver's equalizer to properly update channel estimates and correct received distorted signals.

### ***Conclusion***

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry Vartanian whose telephone number is 703.305.8698. The examiner can normally be reached on 9-5:30 Mondays to Fridays.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on 703.305.4714. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Harry Vartanian  
Examiner  
Art Unit 2634

HV



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